STATUS OF MINERAL RESOURCE INFORMATION FOR THE KICKAPOO INDIAN RESERVATION, KANSAS

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SUMMARY AND CONCLUSIONS

Mineral production of record has not occurred on the Kickapoo Reservation or in the rest of Brown County. Glacial deposits on the reservation have some potential as a source of sand and gravel for local road maintenance. Limestone-shale formations underlie the reservation, but there is little demand for crushed rock or building stone in the area. There may be some potential for brick or tile manufacture from shales. The persistent coalbeds found over much of eastern Kansas probably exist at depth on the reservation, but depth of overburden, thinness of the beds, and high sulfur content appear to make development of coal on the reservation uneconomic at this time. A potential for oil exists, although drilling in the vicinity of the reservation thus far has been non-productive.

INTRODUCTION

This report was prepared for the Bureau of Indian Affairs (BIA) by the Geological Survey (USGS) and the Bureau of Mines (USBM) under an agreement to compile and summarize available information on the geology, mineral resources, and the potential for economic development of selected Indian lands. Source material included published and unpublished reports, together with personal communications. No fieldwork was done.

The reservation is covered by U. S. Geological Survey topographic maps. The coverage is at a scale of 1:24,000 (7½-minute quadrangles). Maps giving complete coverage of the reservation at this scale are:

Horton, Kansas 1961

Horton NW, Kansas 1960

The original Kickapoo Reservation formed a rectangular area 5 miles east-west and 6 miles north-south, consisting of 19,200 acres in the southwestern part of Brown County, Kansas (Figure 1). Most of the reservation land has been sold, leaving 1,735 acres that are tribally owned, 3,377.48 acres that are individually allotted, and 1 acre that is Federally owned (Figure 2). The checker-boarded ownership pattern of the land makes it difficult to describe; therefore, this report covers the area within the original reservation boundaries. Of the tribal land, 785 acres are leased for agricultural purposes at an annual rental of $16,760. Of the individually allotted land, 3,320 acres are under agricultural lease for an annual rental of $34,040, and an additional 38 acres are leased for other purposes at an annual rental of $600 (BIA, 1978).

State Highway 20 passes east-west through the reservation. U.S. Highway 75 is 1 mile west of the reservation's western border, connecting the reservation with Topeka, Kansas and Omaha, Nebraska.

The Kickapoo Reservation in Kansas was established in 1832. Part of the tribe subsequently moved to Texas and Mexico, but many returned by 1873.

The average annual precipitation is 34 inches, with 79 percent of it falling during the growing season of April through October (Bayne and Schoewe, 1967). The only employment opportunities on the reservation are seasonal farm jobs. Residents generally find employment in nearby communities or they commute to Topeka, Atchison, and other cities (Table 1). There are no

commercial establishments on the reservation except for a recreation hall that contains a small grocery store, gas station, and laundromat. The U.S. Public Health Service maintains an Indian health clinic in Horton, Kansas.

TABLE 1
Labor Force, Kickapoo Reservation

	Male	Female	Total
Indian population			
within reservation	240	238	478
adjacent to reservation	50	67	117
Total	290	305	595
Total under 16 years of age	114	121	235
Total over 16 years of age	176	184	360
Employed-earning $5,000/yr. or more	120	38	158
Employed-earning less than $5,000/yr	30	52	82

Source: BIA, 1979

PHYSIOGRAPHY

The Kickapoo Reservation lies within the Dissected Till Plains section of the Central Lowlands Province (Bayne and Schoewe, 1967). The present landscape evolved from the second of two periods of glaciation that covered the area. The glaciers of the Kansas Stage left a mantle of drift of variable thickness; alluvium and glacial drift cover all the upland areas except where the Delaware River and Plum Creek and their tributaries have cut through to expose rocks of either Permian or Pennsylvanian age. Elevations within the reservation range from 980 feet above sea level in the southeast corner, where the Delaware River leaves the reservation, to 1,191 feet above sea level near the northeast corner. Average relief is about 90 feet between stream valleys and hill tops.

The Delaware River, the principal drainage, flows southeastward. Intermittent streams dissect much of the area.

SUBSURFACE GEOLOGY

Rocks of Precambrian age are not exposed in the area of the Kickapoo Reservation. Because few holes have been drilled to the basement in northeast Kansas, Precambrian rock types underlying this area cannot be identified with certainty. Precambrian rocks underlying areas west and south of the area are granitic to quartz-monzonitic igneous intrusives about 1.45 to 1.7 billion years old (Bickford and others, 1979). A series of magnetic anomalies, elongate north-south from southwestern Brown County into eastern Jackson County and western Jefferson County, probably represent Precambrian intrusive rocks of a somewhat different type, one containing higher amounts of magnetite (Yarger and others, 1978; Yarger, personal communication, 1980).

In Brown County Precambrian rocks are overlain by 3500-4000 feet of Paleozoic sediments (Merriam, 1963, p. 78). Formations known to be present include those of Late Cambrian, Ordovician, Silurian, Devonian, Mississippian, Late Pennsylvanian, and Early Permian age (Figure 3).

The Lamotte Sandstone of Late Cambrian age probably is present in the central part of Brown County. Upper Cambrian and Lower Ordovician rocks of the Arbuckle Group overlie the Lamotte, where present, and the Precambrian basement in other areas. Little is known about the thickness and lithology of these older Paleozoic rocks, because few wells have penetrated them (Bayne and Schoewe, 1967, p. 9). The St. Peter Sandstone, Middle Ordovician in age, overlies unconformably rocks of the Arbuckle Group, and is overlain by the Viola Limestone, Middle Ordovician in age, and the Upper Ordovician Maquoketa Shale.

In this area Silurian rocks, unconformable with underlying Ordovician beds, reach a thickness of about 260 feet. These formations are predominantly dolomite interbedded locally with some limestone.

Rocks of Devonian age, also predominantly dolomite, unconformably overlie Silurian rocks. Thickness of the Devonian sequence ranges from 160 to 300 feet. Here the Chattanooga Shale, Late Devonian and Early Mississippian in age, is about 230 feet thick. In northwestern Brown County, Mississippian strata do not exceed 100 feet in thickness, and are locally absent over the Nemaha Anticline just west of the County.

The Cherokee Group, Pennsylvanian in age, is represented by about 650 feet of gray and black shales interbedded in places with sandstone beds. These shales are conformably overlain by rocks of the Marmaton and Pleasanton groups, which in this area have a combined thickness of 200 to 250 feet. Above the Pleasanton Group are 325 to 350 feet of alternating limestones, shales, and some sandstones of the Kansas City Group and overlying Lansing Group. The Stanton Limestone, of the Lansing Group, is overlain by up to 195 feet of shale, sandstone, sandy shale, and minor amounts of limestone that belong to the Douglas Group.

In some areas of northeastern Kansas, the Weston Shale and the Iatan Limestone, members of the Stranger Formation of the Douglas Group, are present. Where these units have been removed, the Tonganoxie Sandstone Member of the Stranger Formation rests unconformably on the Stanton Limestone. The Lawrence Formation of the

Douglas Group is overlain by about 300 feet of limestones and shales that comprise the Shawnee Group. The upper and lower contacts of the Shawnee Group appear to be conformable (Bayne and Schoewe, 1967, p. 10).

SURFACE GEOLOGY

Rocks of Pennsylvanian, Permian, and Pleistocene age crop out in the Kickapoo Indian Reservation (Figure 4). The Upper Pennsylvanian Wabaunsee Group, made up of about 400 feet of shale, limestone, sandy shale, sandstone, and coal, overlies the Shawnee Group. In ascending order, the Wabaunsee Group is made up of the Scranton Shale, the Bern Limestone, the Auburn Shale, the Emporia Limestone, the Willard Shale, the Zeandale Limestone, the Pillsbury Shale, the Stotler Limestone, the Root Shale, and the Wood Siding Formation. Only the Stotler Limestone, the Root Shale, and the Wood Siding Formation of the Wabaunsee Group are mapped in outcrop within the area of the Kickapoo Reservation.

The Lower Permian Admire Group, principally shales with some thin limestones, overlies the Wabaunsee Group. Although a disconformity separates the Permian from the Pennsylvanian, the boundary between the two systems is difficult to determine locally.

In northeast Kansas the Admire Group, about 110 feet thick, is made up of the Onaga Shale, the Falls City Limestone, and the Janesville Shale. On the Reservation all three formations crop out (Bayne and Schoewe, 1967).

The Council Grove Group, also Early Permian in age, is about 220 feet thick, and is composed of the Foraker Limestone, the Johnson Shale, the Red Eagle Limestone, the Roca Shale, the Grenola Limestone, the Eskridge Shale, the Beattie Limestone, the Stearns Shale, the Bader Limestone, the Easly Creek Shale, and the Crouse Limestone. Of these, only the Foraker Limestone and Johnson Shale are known to crop out on the Kickapoo Reservation.

Overlying these Permian rocks are Pleistocene glacial and nonglacial deposits. Although glaciers of the Nebraskan Stage probably covered parts of northeastern Kansas, no deposits of this stage are known to be present on the Reservation. Glaciers of the Kansan Stage covered all of Brown County, and deposits of till and outwash material attain a thickness in places of 300 feet. Wisconsinan and Recent alluvium and terrace deposits are present along streams.

STRUCTURE

Structurally the Kickapoo Indian Reservation is part of the Forest City Basin, which occupies northeastern Kansas and parts of Missouri, Nebraska, and Iowa. Prior to Late Mississippian-Early Pennsylvanian time, the Forest City Basin was part of the North Kansas Basin. In this area this basin now contains about 4000 feet of sediments. It is bounded on the west by the Nemaha Anticline and on the south by the Bourbon Arch (Merriam, 1963, p. 18). The Nemaha Anticline, which trends northeast-southwest, is pre-Desmoinesian post-Mississippian in age. Paleozoic and Permian rocks are generally displaced downward on the east side of the Humboldt Fault, which forms the eastern border of the Nemaha Anticline. Seemingly there

are both normal and high-angle reverse faults along the eastern margin of the anticline. Although the Nemaha Anticline is post-Mississippian in age, pre-Late Ordovician faulting apparently occurred along a northeast-southwest line approximating the trace of the Humboldt Fault (Merriam, 1963).

Minor flexing of the area continued during Pennsylvanian and Permian time, and westward tilting of surface rocks took place principally before Cretaceous time. There was some later deformation and uplift (Merriam, 1963). No faults are shown on the geologic map of Brown County (Bayne and Schoewe, 1967), but the thick glacial cover could mask faults with minor displacement.

MINERAL RESOURCES

No mineral commodities are produced at present on the Kickapoo Reservation. Mineral resources include coal, limestone, sand and gravel, and shale. Oil is produced in the northwest corner of Brown County, but drilling on and near the reservation has been nonproductive.

Coal

Coal is present in the eastern third of Kansas where at least six coalbeds have been mined intermittently over a long period of time. The Elmo coalbed appears to be the only economic bed in the region of the Kickapoo Reservation. It is a persistent bed that can be traced from northeastern Brown County south-southwest to the Kansas-Oklahoma line. Although specific chemical analyses for Elmo coal could not be found, commercial coalbeds in eastern Kansas generally contain 2 to 5 percent sulfur (Hambleton and others, 1975).

An estimated 100,000 tons of Elmo coal has been mined in Brown County. This coalbed, which is commonly 12 to 18 inches thick, has been extensively mined in the Roys Creek area in northeast Brown County and south and southeast of the town of Robinson, which is about 20 miles northeast of the reservation. Most of the mining occurred many years ago, and since about 1934 little coal has been produced except by individuals for personal use. The Elmo coal crops out near the town of Horton, about 5 miles east of the reservation. The Kansas Geological Survey projects inferred coal reserves to within 1½ miles of the east boundary of the reservation (Brady, 1979). The Kansas Survey (Brady and others, 1976) bases its definition of inferred reserves on outcrops or borings showing coalbeds greater than 12 inches thick at a distance from 1.5 to 6 miles between data points. It is presumed that the Elmo coal underlies the reservation, but its development appears to be uneconomic at the present time because of depth of overburden, thinness of the bed, and probable high sulfur content.

The high sulfur content, depth of overburden, and relatively thin seams discourage development of coal in the northeastern portion of Kansas. In the long-range, deep mining would have to be used to recover most of the coal. In view of the thinness of Kansas coalbeds, the economy would have to change drastically to make such operations profitable. Coal mining will probably be restricted to stripping operations in southeastern Kansas in the near future (Hambleton and others, 1962).

Limestone

Limestone-shale formations crop out along the Delaware River and its tributaries within the reservation. Elsewhere, most of the limestone-shale is covered by 35 feet or more of glacial drift.

Crushed stone from the Grenola Limestone and the Dover Member of the Stotler Limestone have been used for road metal, although good quarry sites are limited in Brown County (Bayne and Schoewe, 1967, p. 7). A small outcrop of Stotler Limestone occurs in the southeast corner of the reservation, less than 1 mile south of State Highway 20. Geologic maps do not indicate whether the Dover Member is present; however, if it is, a small quarry operation may be feasible for producing road metal. Its location near State Highway 20 would be an advantage, but the apparent small size of the deposit would be a definite disadvantage. Most Stotler Limestone beds within the reservation appear to be buried under glacial till and other limestone formations. Grenola Limestone has not been mapped on the reservation, even though it does crop out along the Delaware River about 4 miles north of the boundary. Neither the "Directory of Kansas Mineral Producers" nor the "U.S. Bureau of Mines Official Tabulations" show crushed rock or any other mineral production in Brown County for the year 1977 (the latest year available).

Petroleum and Natural Gas

Petroleum has been produced from six wells in the Livengood field in northwest Brown County. During 1978, the field produced 3,695 barrels of oil, bringing its cumulative production since discovery in 1944 to 153,778 barrels (Paul, 1979) (Figure 1). Natural gas has not been found in the county. Figure 1 shows that at least 18 dry holes were drilled within 5 miles of the reservation; depths ranged from 600 to 3700 feet.

On May 17, 1979, an oil and gas lease sale was conducted on the reservation. One bid was received and accepted on 2,224 acres within the eastern three-fifths of the reservation. The lease applies for 5 years. Half of the leased land is tribal and the remainder is individually allotted. Details of the lease are on file at the Horton Agency.

Sand and Gravel

Alluvial deposits, consisting of clay, silt, sand and gravel, occur in relatively large quantities along the Delaware River and its tributaries within the reservation. Glacial till, a mixture of clay, sand and gravel, scattered boulders, and silt, covers the highland between stream valleys. Although fairly extensive quantities of sand and gravel occur within the reservation, its use seems limited to local road fill, probably because of its poor quality and the relatively long distances to large cities where construction activity might provide a market. Most of the Kansas production of sand and gravel is associated with dredging operations along major streams, including the Kansas and Arkansas Rivers. Sand production from these two riverbeds and associated alluvial deposits accounts for nearly 65 percent of the State's total. Open-pit operations are common in western Kansas (Wolfe and others, 1978).

Shale

Pennsylvanian and Permian shale beds are present on the Kickapoo Reservation. Shales in Kansas are used principally to manufacture various types of brick and sewer pipe, and some are used for lightweight aggregate. Potentially, some shales could be used to make quarry tile, drain tile, acid brick, and roofing granules, and they could possibly serve as a source of alumina (Hardy, 1970, p. 9). Apparently, no shale has been produced from the Kickapoo Reservation.

RECOMMENDATIONS FOR FURTHER STUDY

Based on the mineral resource information available, it appears that further study is not warranted at present.

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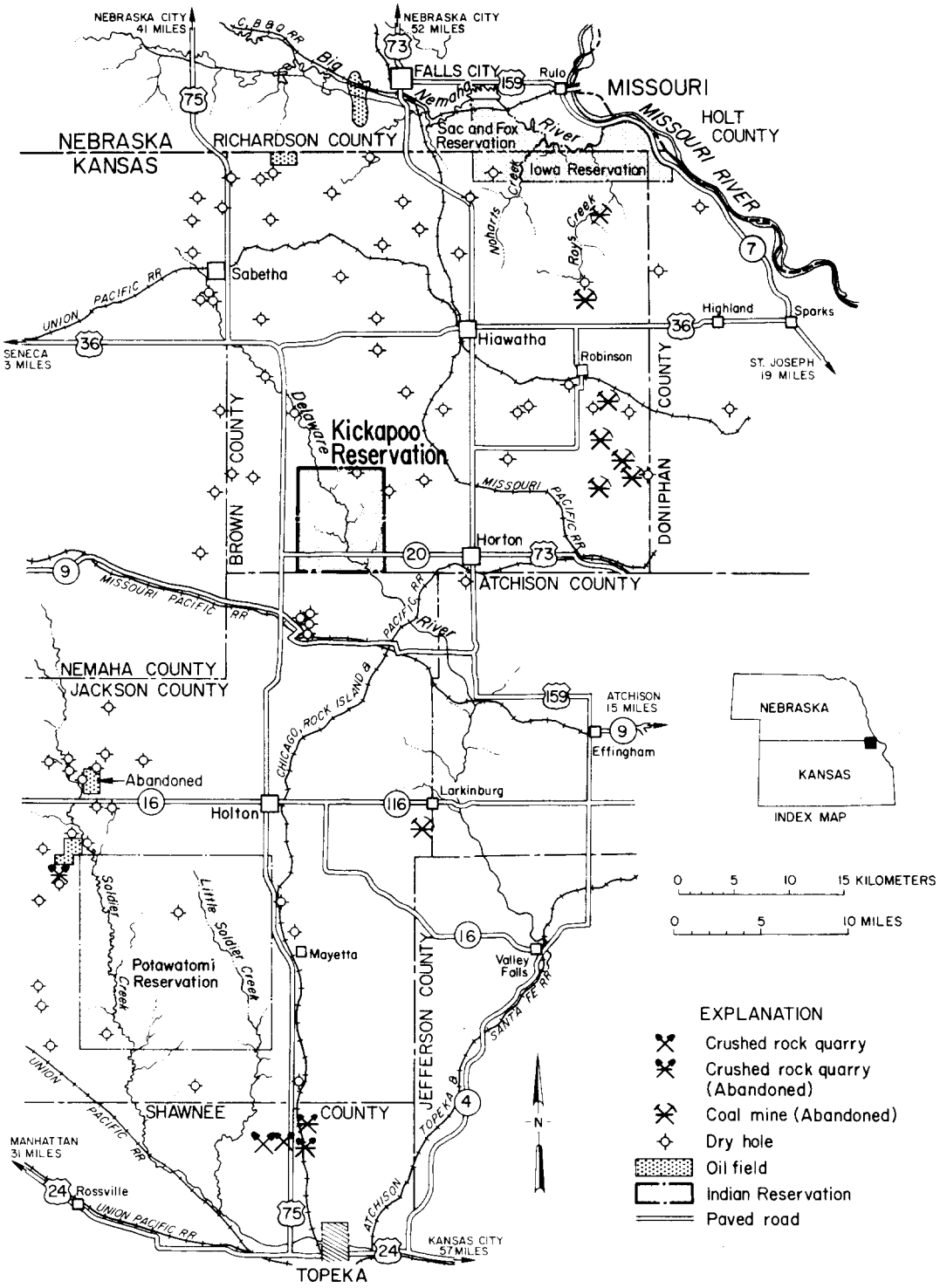

Figure 1. Location and mineral activity map of northeastern Kansas.

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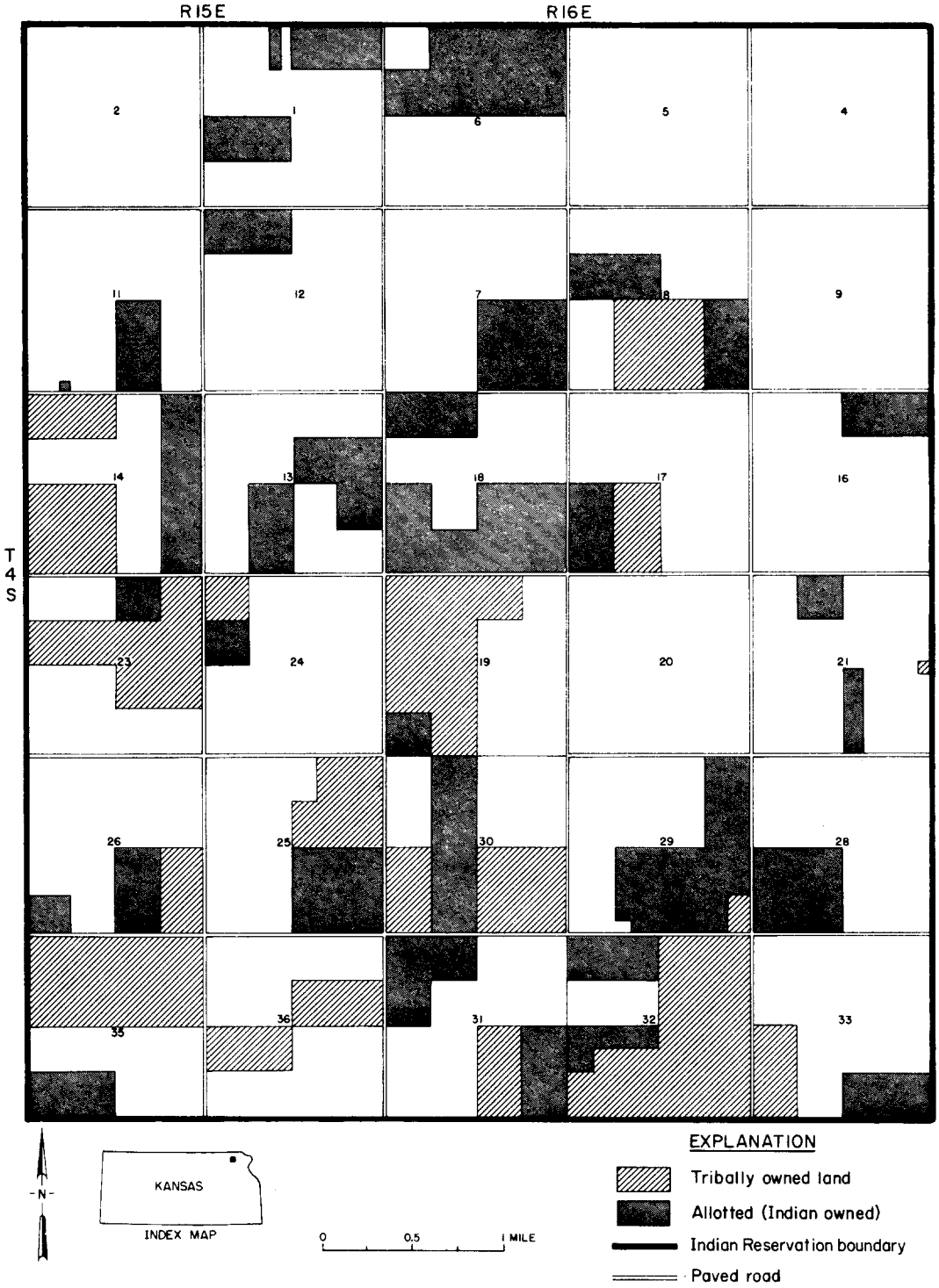

Figure 2. Map showing surface ownership, Kickapoo Indian Reservation, Kansas.

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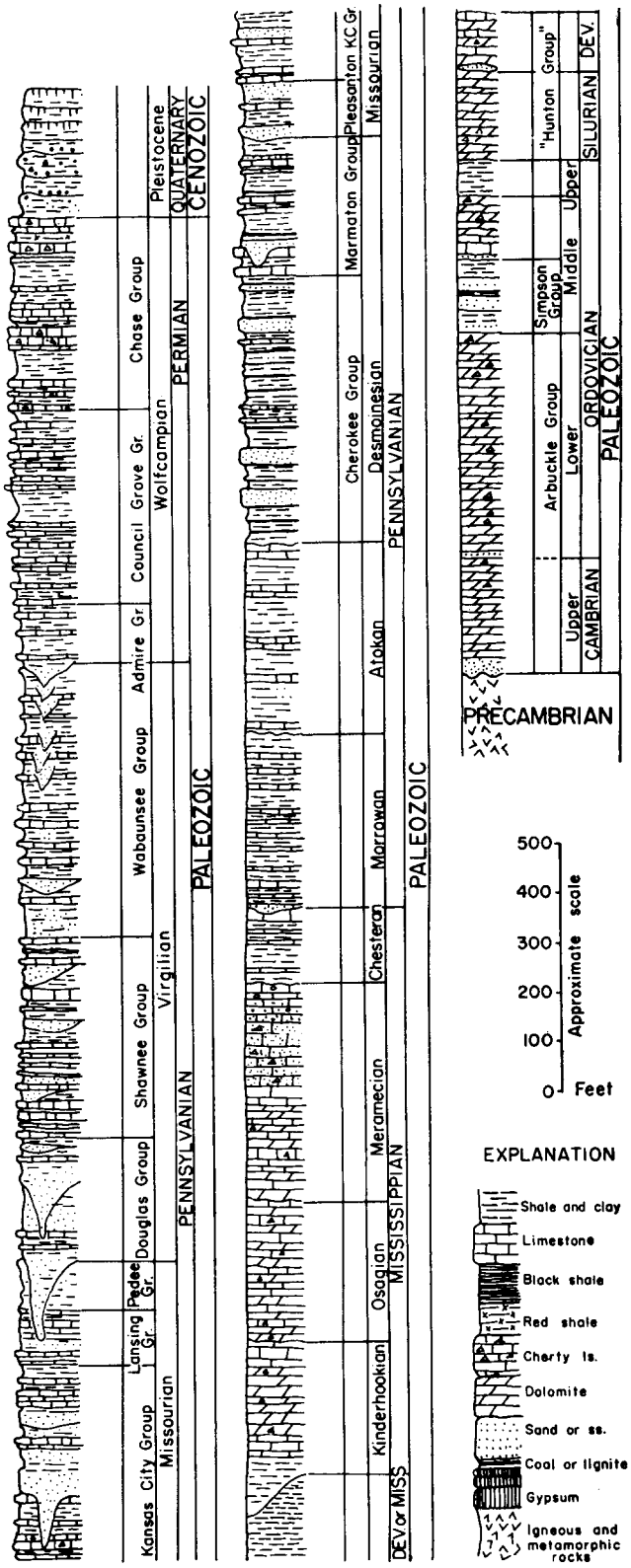

Figure 3. Generalized stratigraphic section of rocks present in northeastern Kansas and southeastern Nebraska (Merriam, 1963; Nebraska Conservation and Survey Division, /1978?/).

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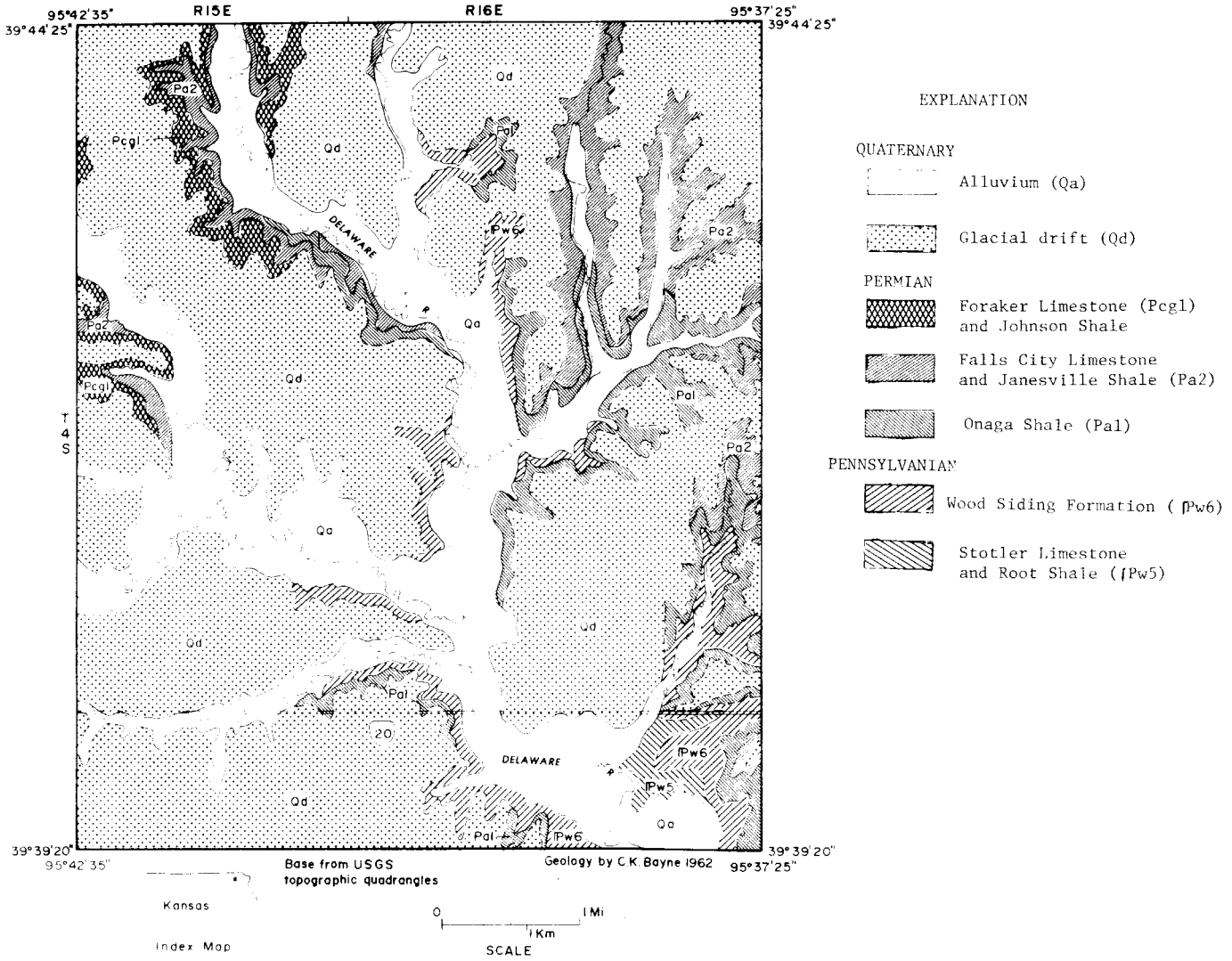

Figure 4. Geologic map of the Kickapoo Indian Reservation, Kansas.